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An INSA Young Scientist Medal Awardee receiving the Award from Sh. R. Venkataraman, Vice-President of India (see also overleaf)

INDIAN NATIONAL SCIENCE ACADEMY
BAHADUR SHAH ZAFAR MARG
NEW DELHI

INSA Young Scientist Medal 1985 Awardees

The following scientists received the INSA Young Scientist Medal 1985 at the inaugural day of 73rd Session of Indian Science Congress Association on 3rd January, 1986.

1. **Dr Vani Brahamachari** (*b.* 6.6.1955) Research Officer, ICMR Centre for Advanced Research in Genetics & Cell Biology, Microbiology & Cell Biology Laboratory, Indian Institute of Science, Bangalore.
   —for her outstanding work on methylation of transfer RNA's and DNA.
2. **Dr Anit Dutta** (*b.* 10.11.1953) Chemical Engineering Division, National Chemical Laboratory, Pune.
   —for his outstanding contributions to stimulation of melt spinning of polyester fibres and elucidation of stress induced migration phenomena.
3. **Dr Raghavendra Gadagkar** (*b.* 26.6.1953) Centre for Ecological Sciences, Indian Institute of Science, Bangalore.
   —for his novel and imaginative work in providing quantitative evidence to show the existence of a behavioural caste differentiation in primitive eusocial insects.
4. **Dr K N Ganesh** (*b.* 25.5.1953) Scientist, Centre for Cellular and Molecular Biology, Regional Research Laboratory Campus, Hyderabad.
   —for his excellent contributions in chemical synthesis and structural studies of oligonucleotides.
5. **Dr Sudha Jain** (*b.* 2.9.1954) Medicinal Chemistry Division, Central Drugs Research Institute, Lucknow.
   —for her extensive contributions in the area of biosynthesis of alkaloids.
6. **Dr R L Karandikar** (*b.* 1.6.1956) B-12 Indian Statistical Institute Campus, 7 SJS Sansanwal Marg, New Delhi.
   —for his outstanding contributions to the theory of stochastic differential equations.
7. **Dr K R Krishna** (*b.* 22.9.1954) Microbiologist, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Patancheru.
   —for his outstanding work in nutrient uptake by VA mycorrhizal association with crop plants.
8. **Dr S B Ogale** (*b.* 24.7.1953) Department of Physics, University of Poona, Pune.
   —for his outstanding work concerning conversion electron Mossbauer spectroscopic studies on alloy phase surfaces formed by ion-beam mixing.
9. **Dr T Radhakrishna** (*b.* 1.7.1954) Scientist-B, Geosciences Division, Centre for Earth Science Studies, Trivandrum.
   —for his paloeomagnetic studies and his contributions to geochemistry of volcanics of the suture zone between Indian and Asian continents.
10. **Dr Arvind Rai** (*b.* 2.7.1955) Deputy Assistant Director and I/C Molecular Virology and Immunology, Division of Microbiology, National Institute of Communicable diseases, 22 Sham Nath Marg, Delhi.
    —for his outstanding research in the fractionation of immunoreactive sub-units of *Chlamydia trachomatis* with potential for use as immuno-prophylactic agent against trachoma.
11. **Dr (Mrs) Madhua Raka** (*b.* 19.11.1953) Department of Mathematics, Panjab University, Chandigarh.
    —for her work settling a long standing conjecture of Watson on minima of inhomogeneous quadratic forms in several variables.
12. **Dr Ramakrishna Ramaswamy** (*b.* 14.10.1953),Fellow in the Chemical Physics Group, Tata Institute of Fundamental Research, Homi Bhabha Road, Bombay.
    —for noteworthy contributions in the field of chaos in molecular dynamics.
13. **Dr D J Saikia** (*b.* 21.1.1956), Tata Institute of Fundamental Research, Post Box 1934, Indian Institute of Science Campus, Bangalore.
    —for his outstanding work in the study of structure of extended radio sources.
14. **Dr Ved Pal Singh** (*b.* 25.1.1953) Department of Botany, University of Delhi, Delhi.
    —for his commendable work in elucidating the mechanism by which aerobic spore-producing thermophilic actinomycetes thrive at high temperature.
15. **Dr G Sundararajan** (*b.* 11.12.1953) Scientist 'C' Defence Metallurgical research Laboratory, P.O. Kanchanbagh, Hyderabad.
    —for his outstanding contributions to modelling solid particle erosion and analysis of high temperature creep fracture of metallic materials.
16. **Dr N Venkataramani** (*b.* 29.6.1953) Plasma Physics Programme, Physical Research Laboratory, Ahmedabad.
    —for his studies of Alfven critical velocity phenomena and physics of scrape off layer in toroidal devices.

Environmental Priorities in India and Sustainable Development *

At the outset may I express my gratitude to the members of the Indian Science Congress Association (ISCA) for electing me the General President for the 73rd Session. I have accepted this honour with humility and am fully conscious of the responsibility it places on me.

The Focal Theme of the Seventythird Session is "Science and Technology in Environmental Management". One of its important facets is "Environmental Priorities in India and Sustainable Development" which is the subject of this address. The 13 Sections as also two Committees and one Forum of ISCA have taken up different aspects of the Focal Theme for their discussion. Taken as a whole, the Seventythird Session is deliberating in a concert on the Focal Theme.

Environment has been defined "as the sum total of all conditions and influences that affect the development and life of organisms". This is a comprehensive definition as it stresses the totality of environment, and that every living organism, from the lowest to the highest, including human being, has its own environment. The objective of the present address is to identify priority areas, and the way corrective action could lead to sustainability in development. This has to be done in relation to our particular social, cultural and economic milieu.

Historically we have been serious minded about environment and the basic philosophy has been one of *harmony* with nature as against western concept of *conflict* with nature. We followed the latter during the last 150 years or so.

Since our independence, considerable progress has been made and today we are among the first ten industrialised nations of the world, thanks to the vision of Pandit Jawaharlal Nehru. Associated with any development, there is always some amount of environmental degradation. Since we did not has a culture of pollution control, we have with us today a huge backlog of 38 years (1947-85) of pollution and eco-degradation. While it is well known that Panditji was very eager on science, technology and industrial development, it will not be fair to him if we do not mention about his concern for the environment. For instance, in 1957, when environement was not even talked about, he wrote: "*We have many large scale river valley projects which are carefully worked out by engineers. I wonder, however, how much thought is given before the project is launched, to having an ecological survey of the area and to find out what the effect would be to the drainage system or to the flora and fauna of that area. It would be desirable to have such an ecological survey of these areas before the project is launched and thus avoid an imbalance of nature*". One marvels at his sensitivity for maintaining environmental balance and one also marvels at the total lack of it at the bureaucratic/administrative level. If the latter had followed what Panditji had said, we would not have been in the present evironmental mess. Let me say, even today, there are people, who believe that there is more money in destroying environment than in conserving it. Tomorrow is not their concern.

Time has come when sustainability in development has to enter in our planning process as one of the basic and permanent objectives. However,

*Prsidential address by Dr T N Khoshoo, General President, Indian Science Congress Association and Foreign Secretary, Indian National Science Academy, delivered at the inaugural function of 73rd session of the Science Congress on January 3, 1986.

sustainable development needs to be properly paraphrased. This address is aimed at provoking a thought process, discussion and a public debate on the subject, rather than talk about it with an air of finality.

Twelve areas have been identified where priority action is needed. Infact these would also constitute important steps towards sustainable development itself.

1. **Population Stabilisation** : Resources shrink as people multiply and demographic pressures lead to economic pressures. There have been a number of discussions on the subject; population, environment, natural resources and development are indeed interrelated. Agewise, India is a very youthful country, with over 72% people being children and youth. Such a situation is also very conducive to further population growth. By 2001 AD, we are likely to have a population between 959 to 1052 m. Can we afford this? When we account for about 15% of the world population, with only 2.4% of the world area available to us. The crux of the matter is that future population growth has to be related to the resource base. Our immediate task is to know the carrying capacity of our country. In any case zero population growth holds the key to our prosperity, and to achieve this the government should even be prepared for a measure of unpopularity. This has to be accomplished in the next 2 decades or so. In turn, it takes us to the borth control strategies, education and vocation for women, which involve considerable scientific and technological imputs including biotechnology and immunology. A policy on population has to be enunciated not in isolation but in concert with a number of related Ministeries Departments.

2. **Integrated Land Use Planning** : Land is one of the important components of the life support system and has been overused and abused. In 1972, Shrimati Gandhi said about land, "*We can no longer afford to neglect our most important natural resource. This is not simply an environmental problem but one which is basic to the future of our country*". Ours is a predominantly agricultural country where land comes first. There are a number of competing demands on land, like agriculture, forestry, grasslands, urban and industrial (including mining) development, and transport. Our land statistics are indeed very confusing and therefore unreliable. For any meaningful planning we need a set of figures agreed upon by the concerned developments utilising modern tools like the remote sensing. This is the first prerequisite. We also need a time-bunnd micro-level Land-use Surey, starting with the village indicating our long term requirements for competing land use will have to be related to soil quality use, and not land economics. The total scenario of landuse will need to be built up meticulously and backed by appropriate legislations, because the existing legislations are indeed very weak.

Connected with land use planning is Watershed Management, a problem of utmost urgency on account of the fact that our water regimes in the mountain ranges are threatened resulting in the depletion of water resources alongwith the attendant problems. Himalayas are the most threatened water sheds of the world and need immediate attention. Wherever science-based reclamation work has been attempted, remarkable results have been achieved and high sediment loads have come down and protective, productive and economic benefits has accrued.

We need to evolve environmentally sound Water Conservation and Management Policy at the earliest, otherwise the much needed gallop in the food production may not come about and, what is worse, rationing of drinking water may become order of the day.

The river valley projects envisaged in future and those that are ongoing need to be looked into for their environmental impacts and due provision made for environmental safeguards. Basin-wise approach needs to be followed and engineering component should be taken in conjunction with catchment and command areas development. The benefit-cost ratio of 1.5 fixed for dams needs to be suitably amended. Irrigation has been a mixed blessing. Unplanned irrigation has caused more problems and losses than it has solved. Irrigation has given maximum benefit under the low rainfall conditions. Degraded, mined and other type of wasteland should be reclaimed and put to some productive use. The MMRD Act (1957) needs to be suitably modified to bring in the environmental safe guards.

3. **Healthy Cropland and Grassland** : The country has performed exceedingly well in agricul ture and production has increased from 50.8 Mt in 1950-51 to 155.5 Mt in 1984-85. It has to go up to

275 Mt in 2000 to feed a billion people. There is an urgent need to boost productivity per unit area per unit of time. A comparison of India and China, the two population giants, shows that China with 1.5 times more population is able to feed its people on 43 M ha less land because both production and productivity are nearly double than that of India. The solution to our problem lies in closing the gap between actual and potential yiedls and thus go vertical rather than horizontal in agriculture. Our agriculture would require another heavy infusion of genetics, especially genetic-engineering and cognate sciences. It is indeed gratifying that ICAR, on its own, has taken to bio-technology. In course of time, it may be possible to release considerable land from the present agricultural holdings. Inspite of the adverse environmental effects of high-input high-output agricultural technology for the foreseeable future, the country will have to depend on this model, which cannot be suddenly changed in favour of environmentally sustainable but low input and relatively low output models like organic farming, no-till or minimum-till agriculture.

The loss of top soil, quantity-wise, is the maximum in India, being 18.5% of the total soil loss at the global level. Strategies to reduce the top soil loss need to be developed on an urgent basis.

The problem of grasslands and overgrazing has not received the deserved attention. It has been responsible for eco-degradation due to the fact that we have world's largest number of livestock which productivity-wise are very poor. A concerted effort needs to be made and a 13 point strategy is suggested in the text.

4. **Woodland and Revegetation** : The effective forest cover today is perilously low being hardly 14%, as revealed by remote sensing techniques. It should have been 33% in the plains and 60% in the hills. The causes are reasonably well know. Coupled with these is the widening gap between demand and supply of wood for diverse uses. The strategy to meet the shortages has to be chalked out against two major objectives of forestry: Affording long term ecological security, and supply of the goods and services to the people and industry through a well thought out plan of production. To achieve these objectives, three broad types of forestry, namely Conservation, Production, and Social Forestry need to be practiced.

Conservation forestry will cover natural vegetation in watersheds and fragile ecological areas and biosphere reserves, national parks, etc where no commercial exploitation can be allowed.

Production or commercial or industrial forestry aims at meeting the raw material demands of all forest-based industries. Here environmental imperatives and production need to be combined As in agriculture, science power needs to be used in forestry, for increase in production and productivity. We have depended so far more or less only on the naturally occuring forestry stock. Time has come to domesticate tree crops as we have done in the case of food plants, and cattle. There is a need to assign this work to ICAR and agricultural universities who should treat it as tree-agriculture and apply principles of genetics, agronomy, plant protection and other inputs like biotechnology and tissue culture.

The third type of forestry is social, community or agro-forestry. These have essentially similar or intergrading objectives, and have succeeded on non-government land. Basically this is a multipurpose forestry for food, timber fuel and fodder to meet village needs that would relieve pressure on conservation forests. The programme is meant for rural poor and is an ancient landuse where land is used for agriculture, forestry and animal husbandry either sequentially or simultaneously. Such an agri-silvi-pastorial model goes well with the predominantly rural setting of the country with over 576,000 villages dispersed over the whole country. One of the important advantage is that once people develop a stake, there is social fencing created for the protection of such forests. This model also goes very well with the essentially biomass-based society and economy of the country as a whole. There are a number of success stories at microlevel in the country. The challenge lies in extending them to macrolevel by removing bottlenecks and constraints.

There is need for considerable inputs in forestry with regard to science and technology, education and training, and demonstrtion and extension, if it has to meet the foregoing objectives. some of the important steps towards this have been spelt out in the main text. Future success will also depend on how well agriculture, forestry and animal husbandry, the three land-based vocations, can be integrated at the village level.

Forestry has been reduced to a game of numbers

(number of sapling planted) often accopanied by a total mismatch between species planted, their end-use and the land-use. It is this mismatch which, for instance, has made social forestry as asocial forestry and given rise to Eucalyptus controversy. We have to realise that a mismatch between a food crop and land can cost us 6 to 12 months, but a similar mistake in forestry will cost us one generation.

Some policy decisions, outlined in the body of the address, including treating forestry as a S & T area, with need to be taken.

5. **Conservation of Biological Diversity** The biological wealth of the country is very rich with nearly 45,000 plants and 65,000 animal species. However, our efforts at conservation have been directed to the conservation (more correctly preservation) of the big cats as also some large mammals, crocodile, birds, etc. and we have altogether ignored plants, forest trees in particular, as also microorganisms and mangroves and marine biological wealth. These are major lacunae in our efforts. Even in the case of big cats, the stress has been on the art of wildlife rather than the science of wildlife. Infact, we seem to have forgotten a simple biological principle that there is *no fixity of species*. A species arises, spreads and in course of time, it wanes due to biotypic depletion and/or changing environmental conditions. Therefore, conservation efforts have to be directed to keep the species away from decline. Obviously, this can not be achieved merely by fencing the area, but by a strategy based on principles of genetics and evolutionary biology.

Another crying need is to based the conservation effort on an ecosystem basis and not on species basis. In this connection on paper we have over 202 Sanctuaries and 44 National Parks but, in practice, we have no idea of the holdings in these areas. There has been considerable *adhocism* in declaring sanctuaries and national parks, some of these are hardly 0.04 sq. km. Areawise all the sanctuaries and national parks have to be related to the minimum area demand of the species (animal and plant) that they are supposed to contain. The areas for which such an indepth excercise has been done by very knowledgeable botanists, zoologists and foresters, are the proposed biosphere reserves. We precisely know what is aimed to be conserved. However, these areas have yet to be declared as biosphere reserves for one or the other reason. These are areas of vital importance to the country. For instance, the Silent Valley and the adjoining regions have contributed 20 major genes for disease and pest resistance in the case of rice. Similarly, India has contributed 152 economic plants whose centres of diversity are located in our country. While we, as also tropical/subtropical world, are gene-rich because centres of origin/diversity are with us, purposeful manipulation of these genes has been done by the developed countries who are crop-rich. The protection of species and varieties that are gene-rich is therefore very important. In time to come, Protected Areas Management will become a major global enterprise and there will be considerable money in this venture in future. If we do not take action now, a gene-rich country such as ours, will be left behind although we have the expertise and experience second to none in the world in this area.

Another aspect that needs to be looked into very urgently is the farming for fur animals, frog legs, turtles, musk and high-value herbal drugs. These species have a use and there is infact already a cottage scale industry based on them. No amount of laws and policing can save these species because it affects socio-economically, the hereditary vocation of the rural communities. Production of these species alone will make collection of these species from wild uneconomical. Crash programmes aimed at domestication and production of these species is called for, because otherwise conservation for the sake of conservation cannot be "sold" to the rural/tribal people.

There is a reasonable understanding of the threatened animals and plants, thanks to the work of Botanical and Zoological Surveys. However, it may be difficult to conserve each and every threatened species. A rationale for prioritisation has been given in the body of the paper. Another way to conserve the important species would be to assign a species of indigenous mammal, bird, tree and a flower to each of our states and also at the national level. At the central level, we could add *pipal* and lotus apart from tiger and peacock. All the 112 species could be declared as National or State mammal, bird, tree and flower by Acts of Parliament and State Legislature. They would then get special protection.

6. **Control of Pollution in water and air** All

development is accompanied by some form of pollution and in our case, the major sources are domestic waste (both dispersed & point sources); thermal power, industry (in particular distilleries and hazardous chemicals), irrigation, auto-exhaust emissions, abuse of agricultural chemicals, etc. Dispersed sources are also important because they affect both air and water. Domestic waste volume-wise constitutes up to 80-90% of pollution, but BOD-wise it is about 50% and the remaining 50% is from other sources.

The Department of Environment and Central and State Boards have been able to control pollution from about 50% of the polluting industries during the last 4 years, an achievement which any country can justly be proud of. However, the backlog is gigantic and is accentuated by the indifferences of other Ministries/Departments/Public Sector Undertakings. Minimum National Standards (MINAS) with respect to some industries have been established. Implementation of MINAS would control pollution at source. Thermal power sector needs to be kept under a very close watch and timely action alone will prevent acidification of our atmosphere. If all units come up, we will have between 0.5 to 1 M t of SO_2 being belched out in the air, and apart from NOx, suspended particulate matter, huge quantity of ash, etc. In the name of power generation, the country may pay much more by way of social costs, health budgets and loss of productivity.

Bhopal should be a constant reminder to every one about how fragile our industrial safety system is and we could have learnt much more from this unfortunate incident.

Water pollution needs to be controlled River Basin-wise, like the Ganga Action Plan. However, the present strategy in Ganga deals with bricks, mortar and drainpipes. Ganga, infact all other rivers are to be looked at as resources. We need to take a total approach including "Solution to pollution by dilution". In this connection, there is a valuable contribution by Rama (1971) supported by Roger Revelle. The rationale is holistic and details are given in the body of this address.

Essentially pollution control can be achieved by laying down realistic minimum standards, proper legal back up and creation of a strong R & D base to monitor and to act as Early Warning System.

7. **Development of non-polluting renewable energy systems** : Energy is a very important input for development. Infact, there is a correlation between level of development and amount of energy used by a country. The non-renewable forms of energy are regarded as energy capital and wisdom lies in not spending the capital. The energy crisis has shown that sustainability in energy sector can be brought about by conserving the non-renwable sources as also by replacing supplement them by non-polluting renewable ones, which are more or less pollution-free, environmentally clean, renewable and socially relevent. Most of the non-renewable sources are highly polluting. Furthermore, no nation can now afford to depend on only one form of energy. it shall have to be a mix of atleast seven forms (biomass, solar, coal, petroleum, natural gas, hydro and nuclear), each supplying not more than 20% of total energy needs of a nation. These should be backed by foolproof environmental safeguards. Furthermore, the relevance of renewable form of energy, particularly biomass, can not be questioned in a country like India where there are over 5,76,000 villages. Firewood still is very important source of cooking and heating in the rural and the urban-poor setting. Th demand is likely to treble by the turn of the century. Firewood crisis can be solved only by crash programme of production of firewood. Furthermore, the nexus between fuel and food and fodder has to be appreciated in a village system. This alone would lead to a decentralised and a local system, because electrifying every village home is still a far cry.

Biogas is another major source for meeting energy crisis in rural areas provided feedstock supply is diversified and is ensured. Other sources are micro-hydel, solar, wind, ocean and geothermal.

There is need for a good measure of R and D input in all form of non-conventional sources of energy and periodic minitoring of performance of these systems.

A perspective in energy scene is yet to be developed. In the immediate future, country will have to conserve to the maximum extent, the commercial sources on the one hand, and replace and supplement the same with non-conventional sources on the other.

8. **Recycling of wastes and residues** : In order to maintain stable economic growth in

future, it is necessary that resources are used carefully and technologies for recycling wastes and residues are evolved. Besides saving energy, resources are a trust of the future generation. There is a global realisation that a nation that will not be able to recycle materials, will not be able to sustain itself because single use will lead to scarcity.

Several developed countries notably Japan and to some extent Holland, Great Britain, West Germany, Denmark and USA are working very actively in the area of recycling and even reuse. Recycling and reuse have been a way of life in China. Both traditional and updated methods are followed to use practically all bio-materials available at the village level. These have considerable social, economic and environmental advantages.

Extent and nature of wastes available in India was assessed by national Committee on Science and Technology (NCST) in 1975. This is an excellent report which may need some updating. The NCST group has made some important recommendations which need to be looked into for implementation. Time will soon come when scavenging will become a big business, and in coming decades, the country has to concentrate on the utilisation of all types of wastes.

9. **Ecologically compatible human settlements and slum improvement** : Negative impacts of absence of housing are indeed a cause of a lot of human misery with consequent degradiation of physical, health, economic, social and cultural environment in urban, slum and in rural areas. Due to doubling of population from 1951 to 1981, there has been 300% increase in persons per km^2. At present, there is shortage of at least 21 M houses, 16 M (76%) in rural areas and 5 M (24%) in urban areas. The population in slums is likely to go up from 28 M to 55.2 M by 1990. Commensurate with this is ill-planned or unplanned or even absence of watersupply and sanitation systems. Furthermore, in any programme on drinking water, sewerage has been constantly ignored. The refuse, therefore, affects water bodies and in turn causes problems of environmental sanitation and health as 80% of the diseases are water-related. The vulnerable sections of our society, and among them women and children, suffer the most.

While gas leaks headline news, even larger number of people die all the time unknown, unheard and unwept due to bad environmental sanitation. How many geniuses we lose everyday is not known. This is the result of strong urban bias. Furthermore, there has been a tendency to accuse the rural and slum dewellers for environmental degradation, but it is actually the urban high-energy and high-consumptive life styles which, in the ultimate analysis, put pressure on the rural system. If we are serious to improve the living conditions of the weaker sections of our society, it is important that the lifestyles of urban people become less energy demanding and less consumptive. Upgraded slums will continue to be slums as long as there is no socio-economic upliftment.

There is also an immediate need for R & D with regard to utilisation of traditional, locally available building materials, and architecture in relation to local ecology, low cost latrines using minimum water and parameters for environmentally compatible human settlements. Regarding the last item, a list of prerequisites has been given in the body of this address.

10. **Environmental education and awareness** : One of the very important priorities of the present Union government is education. Infact with the acceptance of the Tiwari committee Report (DST, 1980), the country has accepted the need for environmental education. The basic rationale is the people, they themselves are a renewable resource and we need to train them so that they could help to restore our environment. Many conferences, national and international, have been held, but the fact remains that most people recognise the urgent need for environmental education, but only some have clear ideas about what needs to be done, and very few have either the actual experience or the knowledge about the courses that need to be taught. The attempt should not be to introduce a new subject, but a *new approach* to environmental education which cuts across various subjects. The idea should be to bring environmental concerns in all subject areas so that environmental bias permeates into all facets of one's life and does not get compartmentalised at one place.

Basic rationals of designing courses in the formal education sector at school, college and university has been spelt out in the text of this address.

The non-formal sector must cater to adult

education, rural youth and non-student youth, tribals and forest dwellers, children, public representatives, senior executives and administrators, and foundation courses for probationary officers from various services including armed forces, and trained manpower (teachers, professionals, technicians and legal experts).

11. **Updating Environmental Law** : While there is a plethora of Central and State laws/enactments which have direct or indirect relevance to environment, none, except perhaps Water and Air Acts, take care of the short and the long range effects on environment. For instance, a number of laws may be related to hazardous chemicals but none take into account the basic fact that these chemicals can enter the life support system and the food chain and ultimately affect the human being. The basic question whether environment should figure in Union or Concurrent list also needs to be looked into. There is an urgent need to update the existing laws, infact this has to be a regular activity so that laws are able to meet the newer environmental challenges and insulate the country from future environmental damage. An indicative list has been given in the body of the address. Environmental law is not law alone, it is law in combination with scientific and technical data without which neither effective laws can be formulated nor cases can be decided objectively so as to ensure sustainability in development.

Today, thinking is growing all over the world that all the living beings have a standing and an intrinsic value, an opinion expressed some 3000 years ago by Charka in India. Therefore, all living things, plants and animals, have a right to live. This goes well with our own conservation ethic.

12. **New Dimensions to National Security** : The prevailing concept of national security is confined to the defence preparedness to meet threats from within and, more importantly, across, the borders. Defence all over the world is the largest budget head of most nations. This concept has been widened by talking of food security which envisages "physical and economic access to food to all people at all time". Food security has been further refined to include nutritional security. However, we have always ignored a bigger security, the long range environmental security, which is a non-military threat. We are waging a war against our life support system and we seem to be winning the same. This realization is coming to our hill people and an ex-serviceman had said: "*I was in West Bengal Rifles for 27 years and I fought three wars. I have now returned to my village. My enemy is no longer Pakistan or China, it is land slides. We live in fear of land slides. We need trees to give us healthy environment so that we can survive*". This is the prevailing opinion in the entire Himalayan belt, where people have become aware of the dangers to their very existence and demand curative action. The future of 400 M people in low lands of Pakistan, India and Bangladesh, depends on the well-being of Himalayas and its 46 M people in Pakistan, India, Nepal, Bhutan and Burma. For instance, what happens in Nepal Himalayas must inevitably affect us in the Indian plains. Here then is a very important item for bilateral cooperation as also for regional cooperation between the countries in the entire Himalayan belt for the good, the welfare and the benefit of their people. History is replete with instances where civilizations have fallen just because the countries concerned did not take care of the environmental base. Therefore, we need to ensure our national security. Environment transcends geographic boundaries and merits attention with minimum political differences and inevitably it must enter the area of foreign relations.

General Considerations : The words "economics" and "ecology" have the same root, *oikos*, which refers to "house". While economics deals with financial housekeeping, ecology deals with environmental housekeeping. Time has come to see that economic planning and environmental protection have identical goals, i.e. sustainable development which, therefore, must get deeply integrated in planning process. Sustainable development is necessary on a long term basis, and in common parlance, would mean spending the interest while keeping the capital intact.

I have spoken marginally about non-renewable resources, but the concept of sustainability will apply to these resources much more than the renewable ones. The present generation has to think about what it owes to one that will follow. How much of coal, petroleum, minerals, etc. do we have and what is the pattern we should follow to make it last longer. This has to be coupled with a major programme on recycling and reuse.

The option before us is either a throw-away and one-way society or a sustainable and earthmanship

society. The present day throwaway or one-way society can become sustainable only if there is infinite supply of materials and energy. It presupposes that the environment has equally infinite ability for absorption and resilience to return to its original condition, after unlimited quantities of waste and heat are generated. Experience has shown that this is no longer tenable particularly on account of the escalating population and shrinking resource base. The other model is sustainable or earthmanship society aimed at recycling and reusing materials, conserving energy, controlling population and pollution, and lowering the rate of consumption of materials (including forests) and energy by deliberate choice, so that resources are not depleted and environment does not degrade due to being overloaded with wastes and loss of vegetal cover. This model goes well with our conservation ethic. The choice, therefore, is clear.

It is high time that we stop confining only to what may be called as reactive-environmentalism but move on to long range environmentalism. Reacting to the local environmental issues is only "skirting the basic issues". One such basic issue discussed below relates to the model of development itself that we should follow for the unusually large number of villages we have. This is why Gandhiji aptly said that India is in villages "*If villages perish, India perishes*" It is indeed a far cry that through central grids, we can meet the minimum basic needs of all the villages. The centralised planning has failed to percolate fully to the grassroots. Essentially, the village society and economy is biomass-based and for ameleoration of the condition of the rural poor there is need to enhance the productivity of biomass on a holistic basis. The ecosystem need to be built up, nursed and cared for. While discussing cropland, woodland and grassland, the three land-based activities, and their nexus with rural energy, it emerged that we need an agri-silvi-pastoral model of development. This alone will need to self sufficiency at the rural level while keeping environment clean and forging sustainable development.

Between the industrial development model and the biomass-based model, a perceptible tilt should be given in favour of the latter, which essentially is based on photosynthesis. This goes well with the fact that Indians are, by and large, vegetarian and there is an in-built veneration for all life. Among other things, the model envisages revegetating the uncultivated half of India and making the country verdant. This would have distinct environmental, social and economic benefits and will help in the following ways;

—Conservation and improvement of soil and water
—Stabilisation of catchments and watersheds;
—Control of floods;
—Better microclimate
—Creation of aesthetic and pleasing landscapes;
—Better health;
—Better quality of life;
—Halting influx of rural population into urban areas; and
—Decentralised economy.

One way to achieve this on a priority basis under the National Rural Employment Programme (NREP), Employment Guarantee Scheme (EGS) and several other related programmes, is to ensure massive public participation, involving students volunteers, ex-servicemen and public at large, for the success of a massive field project like the restoration of degraded land and ecosystems. Infact, the people can be organised at national, state or local level into Conservation and Development Corps (CDC). The programme would instil in the young people a work ethic and sense of pride. The underlying philosophy is to make villages self-sufficient with regard to food, fodder, fuel and timber by producing or raising those materials that are in demand at the village level. Meaningful results have been achieved in a short time wherever this model has been given a fair trial.

Four important issues of policy nature have emerged from the actual work and working at Centre and in States as also discussion of environmental issues in this address. These are:

1. The plans for environmental management should be integrated in all the developmental activities of all sectorial authorities (from a ministry/department/development agency/corporate body/municipal council down to panchayat) who have the primary responsibility for environmental protection. Implicit in this statement are the following points:

—A mass education and awareness programme from primary school children to professionals, policy and decision makers and everyone in

between.

—The Department of Environment at Centre and in States have to perform a "Watch Dog" Role and clubbing them with other Departments would be counter productive.

—Key to the success in environment lies in cooperation between central and state governments.

—Environmental management (including Impact Assessment) should be a statutory obligation for all developmental projects.

—For sustainability of high productivity, resources have to be made available for all times to come. It is only possible if we manage them well.

2. Programmes on environmental amelioration can succeed only when participation of public is secured and ensured and public at large develop a stake in environment.

3. A strong S and T base is needed for environmental research and development, education and training and demonstration and extension. This is an essential pre-requisite for any meaningful progress in this area. Equally important area of work is the social cost benefit, in other words, at whose cost and to whose benefit.

4. Machanisms need to be strengthened for ensuring:

—Corrective or curative or restorative action with regard to environmental damage that has already taken place. An example of such action is mission on Ganga.

—Preemptive action needs to be taken regarding the environmental damage expected from the future developmental activities and thereby insulating the country from further damage. An example of this is the stoppage of the Silent Valley Hydroelectric Project in favour of the role this area has as a repository of biological diversity.

Suggested Recommendations : The principles of environmental management will have to be applied to all developmental activities. Inherently, environmental management is interdisciplinary and inter-departmental/ministerial in character. Furthermore, in our country, land, water and forests are state subjects which means a very high degree of interface between the Central and the State Governments. There is, therefore, an urgent need for a national body, outside the Department of Environment, to advise the Government on pressing national environmental issues. Such a role was apportioned by the previous Government to the Scientific Advisory Committee to the Cabinet and some excellent work was done on forestry and hazardous substances by the previous SACC. The same arrangement can continue, or this work can be assigned to a small tight body of 2-3 persons, like the Council of Environmental Quality (CEQ) advising the President of the United States. CEQ was in the President's Office, outside the jurisdiction of the Environmental Protection Agency (EPA), which is the counterpart body of the Department of Environment and the Central Board in India. With this in mind, the following recommendations are suggested:

1. The most urgent and pressing problem is the preparation of the National Conservation Strategy (NCS), not only involving Governmental but more importantly also Non-Governmental Organizations. In fact, NCS would lead to National Environmental Policy. However, before it can be accomplished there would be needed clear statements on population policy, Interface between population, land, food and other resources, carrying capacity; integrated landuse management, landuse classes, land capability survey and landuse policy; and other cognate issues regarding river valley projects, dams and irrigation; mining; policy on recycling and reuse; policy on hazardous substances etc. All these issues can no longer be brushed aside and have to be dealt with scientifically on an urgent basis.

Such a supra Departmental Body could also prepare environmental perspective on issues of national, regional and global importance.

2. The recommendation of the Tiwari Committee about appointing well-trained and well-informed Environmental Advisers in all the ministries needs to be activised at the earliest.

3. A policy research and training institute on the management of environment needs to be established to look after the training needs for Environmental Advisers as also take up work on some of the policy issues outlined above.

4. Special attention needs to be paid to the rehabilitation of Himalayas and work on Himalayan Institute on Environment and Development needs to be expedited as a Network Institute. The

Government has already decided to name the Institute after Shrimati Indira Gandhi. Work needs to be intensified on this project, not only nationally but also regionally.

This address is rather long. The reason being, a constant clamour for authentic information from teaching, training and research institutions. The information is very dispersed and not readily available. I have tried to but between two covers in the hope that it will prove to be useful.

So far, the nationas of the world did not have a common past, but are now moving towards a common future through the area of environment on which depends the very existence of the human race. The thoughts expressed in this address are dedicated to the memory of a great leader of our time, Shrimati Indira Gandhi. Posterity will always remember her for the thrust she gave to the environmental movement both in India and at the global level. May her memories guide us to right action in the area of environment.

Let me end where I began. Environment is truely multi-disciplinary area and all of us are in a learning phase. We need collective wisdom from various disciplines to solve environmental problems which are often very complex. Let us recapitulate the aphorism from the Rigveda; "Let knowledge and Noble Thoughts come to us from all sides"

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The Government of India has reconstituted Science Advisory Council to the Prime Minister (SACP) on February 4, 1986 with Professor **C N R Rao**, President, INSA and Director, Indian Institute of Science, Bangalore as its Chairman. The other members of the Council are: Professor J V Narlikar, FNA (Tata Institute of Fundamental Research, Bombay); Professor P N Tandon, FNA (All-India Institute of Medical Sciences, Delhi); Professor R Narasimha, FNA (National Aeronautics Laboratory, Bangalore); Dr A S Ganguly (Hindustan lever, Bombay); Dr Sekhar Raha (Indian Explosive) and Professor Madhav Gadgil (Indian Institute of Science, Bangalore). This council replaces the previous Science Advisory Committee to the Cabinet (SACC) which had Professor M G K Menon, FNA as its Chairman.

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Professor **M G K Menon**, FNA, FRS, Past-President, INSA has been nominated as the Scientific Adviser to the Prime Minister of India. He continues to be the Member, Planning Commission also.

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Prime Minister's Address on the Concluding Session of the Indian Science Congress Association on January 7, 1986 at New Delhi

Addressing the concluding session of the 73rd Indian Science Congress, the Prime Minister, Shri Rajiv Gandhi, said here today:

"Indian scientific tradition dates back to ancient times. There was a period when India was sought out as a centre of learning, the centre of science and technology of that period. Indian scientists have given an appreciable contribution towards the development of science in those days. Without going into the long list of specific details let me quote from a seventh century Syrian bishop, Severes Sebokht. Referring to Indian scientists, he says, '*there are a subtle discoveries in astronomy—discoveries that are more ingeneous than those of the Greeks and the Babylonians—their valuable methods of calculation and computing which surpasses description.*' That pherhaps describes what science in India was like, a couple of thousands years ago. Unfortunately, we have gone through a perriod of subjugation which saw the destruction of this scientific and technological tradition. It saw India reduced from a much sought after destination for knowledge and riches to an under-developed and developing country. Today the challenges that our scientists and technologists face is, in a sense, perhaps even greater than the challenges which their predessors faced a couple of thousands of years ago. The challenge is not just to catch up, to equal what is going on in the rest of the world, but to surpass and once more give a lead that we used to some thousands of years ago. Our scientists must concentrate on areas which are most meaningful for a country like India. And in today's circumstances it means in the rural areas, the agricultural sector, and the various sectors that support our agricultural and rural industry.

The challenge perhaps is not for the scientists themselves who have shown considerable achievements during these past years. Our scientists have put India in a strong self-relient position, not only in agriculture but also in certain other strategic areas, where it was difficult for us to import technology and knowledge. So, whenever there has been a real challenge, where the chips have been down, our scientists have risen to the occasion and have shown the world that they are second to none when it comes to capability, competence and achievement. The question today is how are we going to spread this out to other areas. I emphasize areas because just as we have been tremendously successful in certain specific areas, we have been wobbling around and not really achieving much in many other areas. The question is not just of the scientists. The real question which we are facing, not only in science and technology, but generally across the board, is that of management. How are we going to handle our scientific management? How are we going to handle our scientists? This perhaps is the root of getting more output from our scientists. Pandit Nehru addressing the Indian Science Congress in 1963 had said, "*Our Labs have done good work and yet I have a feeling that all is not quite well with these labs*". Perhaps, I could repeat that, today.

Questions of seniority, bureaucracy into scientific management, a mediocrity creeping in at the higher administrative level and many other such questions have to be answered. These can only be answered by you. The only real way to get out scientists—out best scientists operational in their fields—is to not accept mediocrity at any

level. This is the real challenge that our scientists must tackel on their own. We have seen by experience that where we have set out a particular task or challenge, our scientists and technocrats have responded and delivered. Perhaps it was seeing a goal in front or just the fact of having to deliver or to have to wind up a particular scheme—the threat of a closedown of a particular research which trigerred them. But the fact is that is has worked and we have now tried to follow this in other areas as well.

We have already identified certain thrust areas where we will concentrate just in a manner as we have done with our space research, nuclear research, food production and with some other areas. We would like to now broaden that first into those area which are critical to us: energy, oilseeds, certain high technology areas where we need the technology which we are not able to get from other countries. What is really required is not just for Government to sponser scientific research. Government sponsorship will perforce be limited to certain areas and also in quantum to certain limits. We have traditionally achieved too little on scientific research. We have to increase this. But we must get a proportionate increase also from industry and from various other sectors. We have to try and see that our research is once more brought into the centres of learning. Our universities are not being used for research as they should be. Our industries are not going to our universities and wanting research done, wanting improvements. This, somehow, must happen. We have already given instructions to the public sector units that they must go to universities and other laboratories and ask for results. Similarly, we have asked our defence industries to try and reach as many institutions as possible and not to concentrate in their own few establishments. Again this will give a new life and a new thrust to scientific research right across the country.

But still what is lacking is a demand to improve what we already have imported. If we get a technology, whether it is a production technology or a particular technology for defence or for any other frontline technology, we must not be satisfied with just getting it and sitting on it for twenty or thirty years and suddenly saying my God, we have got left behind. That is only a stepping stone, a starting point from which our scientists must take up the challenge to catch up and get ahead of other countries in basic research. Today in India we are in a position to take this lead. For much too long we have been playing this game of chasing other people's research. It is not good enough and is not going to work any longer. It has served its purpose during this phase of our development, but that phase is over. We must target for frontline research now and not try and do what others have already done. We must learn from what has been done, and take that jump to the front, to the cutting edge of research and technnology. I know that the capability is there is our scientists, but all it requires is little bit more thrust.

I think we are amongst the top countries in the number of papers that our scientists produce. But how many of these papers are quoted by other scientists. How many are referred to by others? Do we ever hear of these papers some years later or do they just disappear? This is a question that we must fare and we must see that what we produce is really top-grade frontline stuff. We have the capability and our scientists have demonstrated it. We must bring them out and let them flower in a similar manner in every field. Of course, our funds are limited and it will mean certain restrictions, but what is required is that whatever investment we make is utilised in the most effective manner. We are today looking towards developing various technologies whether it is in energy, food production, oilseeds or in certain specific defence areas. What we are looking for is to use the most modern technology for the benefit of the poorest, the most depressed in our country.

There have been theories of appropriate technology, but appropriate to me means second-rate, means being deliberately kept backward so that we keep playing a game of catch up. We are fed-up of playing the game of catch-up, we want now to get on to the front-line. We should not be satisfied with second-rate technologies and second-rate development. We must go to the front areas. Our farmers have demonstrated that they are capable of using front-line technologies, that is why we are self-sufficient in food today. And if our farmers, who perhaps could have been considered one of the most backward groups as far as scientific education is concerned, are capable of this jump, then almost every section of our society is capable of absorbing technology. We have to see that we create the correct educational environment for

them to be able to absorb these. Scientific research is not just a question of producing a few hand-picked scientists who can reach pinnacles of achievement. It must be supported by a very broad base of people who have scientific learning and understanding, from which we can draw and reach out to the best people that are available. This we have not been able to do. We have got pillars which reach out to great heights, but they remain pillars, we have to turn them into pyramids. When Panditji talked about the scientific temper, it was not limited to developing a handful of scientists, it was a scientific temper that had to permeate down to the average Indian; whether he was living in a town or in the remotest village. This perhaps is another major challenge that we must face. We have to develop our education system so that this scientific temper permeates down to average person. It is only when that happens that more people will be drawn into the scientific field. It will give us the opportunity to tap the best brains which today are not easily accessible to us.

You have been discussing and talking about ecological problems. Perhaps this again is one of the biggest challenges that India and the world faces today. As science develops it is no more a question of how fast, or how good our research is. It is more a question of whether man himself as a human being will be able to advance adequately to cope with this knowledge that he is gaining. Will he be able to handle this knowledge or will science and technology take over and lead us down the path which ends in some sort of holocast—either a traumatic nuclear holocast or on an environmental collapse. And the challenge is in linking the development of the human being with the development of science and technology. In India, traditionally we have concentrated on the development of the soul and the mind—the spiritual development of the human being.

Today the challenge that we are faced with is of combining this traditional Indian heritage with a modern material development. It would not be satisfactory for us to achieve only the material development, the technological development. We have to match it with the development of the human being, the spiritual inner development of every individual in India. We are trying to marry the two to get the best from both. We feel that without this linkage we would not be getting true development of the individual in India. With out traditions we believe that we may be able to find some options which have been rather elusive. Our task in India is to end poverty, and the challenge to our scientists is of how modern scientific and technological knowledge can be brought to achieve this goal. How we can bring our rural, more backward areas not just a step behind the other countries but equal to the most developed countries? The challenge has been in front of our scientists, in specific fields. They have shown that they can do it. I look forward to our scientists accepting this challenge and bringing India not just a step behind the most advanced countries but certainly in the coming years ahead of certain countries, ahead of the most developed countries in certain fields and slowly in all the fields."

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SOVIET SCIENTISTS HONOURED

The Indian National Science Academy has honoured two eminent Soviet scientists, Professor **A P Alexandrov** and Professor **V A Koptyug**, President and Vice-President of the USSR Academy of Sciences respectively. Professor **C N R Rao**, President INSA and the leader of the INSA delegation, presided over the function. It was attended by eminent Indian and Soviet scientists and academicians.

The Indian Ambassador to Moscow, Professor Nurul Hasan, who was also present in the function, praised the close cooperation between Indian and Soviet scientists.

* * *

National Conference on Long Term and Short Term Hazards of Pesticides and Strategies for Their Safe Use*

Foodgrain production in India has gone up from 52 million tonnes in 1952 to around 152 million tonnes last year. This increase in production was essential to feed the large and growing population, to increase nutrition levels and to ensure food security under adverse weather conditions. The Seventh Plan envisages a growth rate of 4% in agriculture with foodgrain production to touch 182 million tonnes by 1990; by 2000 AD we will need to have a production of about 225 million tonnes. This has marked a change from the earlier subsistence agriculture to new intensive agriculture; the principal inputs to the latter are normally assumed to be the new seed varieties, nutrient input in the form of fertiliser and water. It must be remembered that an equally important component, in increasing and sustaining food production, has to be plant protection.

India being in the tropics is subject to 5 to 10 times as many diseases and pests affecting plants compared to what obtains in the temperate latitudes. In the USA it is estimated that the magnitude of loss due to disease, nematodes, insects and weeds is around 25%; in India it is likely to be as high as 50%. The importance of pest control lies in it being a preventive measure which can bring more food to the table at lower costs than what would be involved in increasing production to the same extent even if it was feasible; further it enables production at lower costs.

The use of pesticides is about half a century old. The first development of Thiocarbamate as a fungicide was in 1930. A major development took place with the discovery of DDT in 1939 followed by the range of BHC, 2, 4-D, cyclodienes, etc. These were low in cost, potent, safe to handle, and persistent in the environment which was considered as an advantage. Today we consider this persistence as leading to residue accumulation and thereby a hazard in the long run. Because of this, degradable organo phosphorous compounds and carbamates came into being. In the mid-seventies synthetic pyrethroids entered the scene.

In India, DDT has been used principally as an insecticide in the National Malaria Eradication Programme; its use in agriculture has been very limited. Overall, from 2500 tonnes in 1955 India now uses around 70,000 tonnes of pesticides of all types. The usage of pesticides in India is low compared to the developed countries of the world. Also, from time to time, when deleterious affects of pesticides have been noted, control measures have been introduced. Overall, in India the use of pesticides has been reasonably cautious.

However, with the increase in food production envisaged, and the need to cut down food losses in the field and storage, pest control measures assume great significance. It is important that these are introduced so that the costs of production are kept low and unnecessary losses prevented. At the same

*Inaugural Talk delivered by professor M G K Menon, Past-President, INSA, Member, Planning Commission and Science Adviser to the Prime Minister on February 24, 1986 at Academy premises.

time, it has to be ensured that the use of pesticides does not lead to long or short-term hazards. Apart from these biologically active chemicals, there is a range of other possibilities, such as ptheromones, which have now reached the field stage and can be involved in sound plant protection techniques, as also physical, mechanical, cultural and various biological control techniques, including the use of parasites, predators microbial agents and viruses. What is called for is a sound Integrated Past Management approach, as envisaged in the seventh Plan. What would be important to evolve is a balanced multi-pronged approach, in which chemical pesticides will no doubt continue to play an important role.

There is need to give high priority to the area of plant protection and pest control, and evolve sound national policies in this regard covering research and development, production, application, environmental control and necessary aspects of legislation.

* * *

Mani Shamji Chawla, the 30 year old proud mother, is carrying the first Indian test tube baby at KEM hospital, Bombay. The foetus is 12 week old now. The successful *in vitro* fertilization programme is led by Dr Indira Hinduja. Her team consist of six scientists from Institute of Research in Reproduction, Bombay and four doctors from KEM hospital. Meanwhile, the *in vitro* fertilization project has also been launched at AIIMS, New Delhi with Professor Kamal Buckshee, a Gynaecologist, in collaboration with Professor G P Talwar, FNA, Director National Institute of Immunology.

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IMPORTANT ANNOUNCEMENT

1. Nominations for election to Foreign Fellowship have been invited from the Fellows of the Academy. Nominations are to be made in a prescribed proforma which can be obtained by the Fellows on request from the INSA Office. The last date of submission of nominations is 5th April, 1986.

2. Nominations have been invited for the following lecture awards due in 1986:

   i) The Professor T S Sadasivan Lecture Award
   ii) The Professor B D Tilak Lecture Award
   iii) The Professor R K Asundi Memorial Lecture

While nominating, the following information is to be given:

1. Name of the award
2. Full name, age and address of the nominee
3. Academic and professional qualifications and positions held
4. A brief statement (of not more than 100 words) of the major scientific achievements of the nomines on which recommendation is based.

The last date for submission of nominations is 15th March, 1986.

Awards and Honours

Science Academy Medals

Vishwakarma Medal 1985

Srinivasa Ramanujan Medal 1985

The Vishwakarma Medal was established in 1976 from an endowment made by Dr P B Sarkar, Fellow of the Academy. The Medal is awarded every three years to an eminent scientist, technologist or any one whose discovery or invention has led to the start of a new industry in India or to significant improvement of an existing process resulting in cheaper or better product. The award carries an amount of Rs. 7,500 and a Bronze Medal.

The Medal for the year 1985 has been awarded to Professor **Man Mohan Sharma**, FNA, Professor, University Department of Chemical Technology, University of Bombay for his outstanding contributions in the field of Chemical Technology. Professor Sharma delivered the Medal Lecture on **'Intensification of heterogeneous reactions : Theory and Practice'** at INSA, New Delhi on 1st January 1986. He received the award from Professor C N R Rao, President of the Academy, at the Anniversary General Meeting of the Academy on 2nd January 1986.

The earlier recipients of the award are:

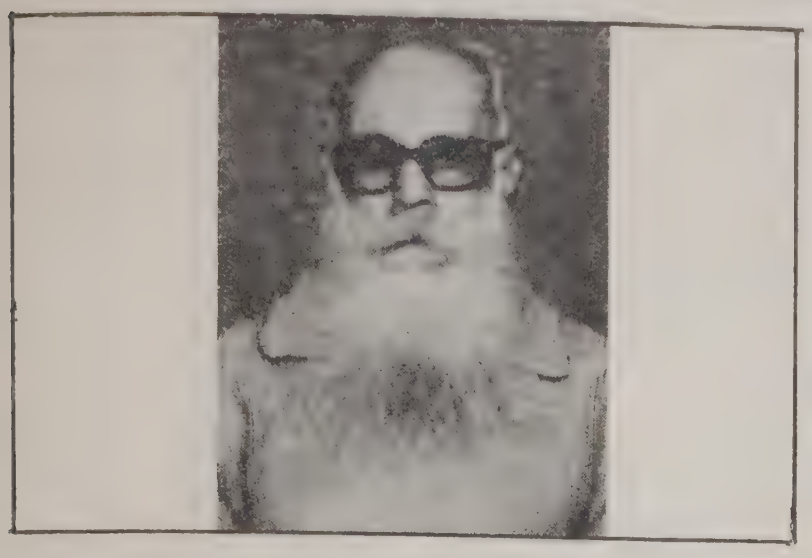
Dr Sukh Dev, FNA (1979)
Dr Nitya Anand, FNA (1982)

The Srinivasa Ramanujan Medal was established by the Academy in 1961 in memory of the distinguished mathematician. The Medal is awarded every three years to a scientist for outstanding contributions in Mathematics or a related subject. The award carries a Bronze Medal.

The Medal for the year 1985 has been awarded to Professor **Conjeevaram Srirangachari Seshadri**, FNA, of the Institute of Mathematical Sciences, Madras for his outstanding contributions in the field of Mathematics. Professor Seshadri delivered the Medal Lecture on **'Standard Monomial theory and Geometry of Schubert varieties'** at INSA, New Delhi on 1st January 1986. He received the award from Professor C N R Rao, President of the Academy, at the Anniversary General Meeting of the Academy on 2nd January 1986.

The earlier recipients of the award are:

Professor R P Bambah, FNA (1979)
Dr S Chowla, FNA (1982)



Professor T R Seshadri Seventieth Birthday Commemoration Medal 1985

The Professor T R Seshadri Seventieth Birthday Commemoration Medal was established in 1971 from an endowment made by the students of Professor T R Seshadri, an eminent organic chemist and a Fellow of the Academy. The Medal is awarded every three years to an eminent chemist of Indian nationality for outstanding work in any branch of chemistry or chemical technology. The award carries an amount of Rs. 1,500 and a Bronze Medal.

The Medal for the year 1985 has been awarded to Professor **Dilip Kumar Banerjee**, FNA, former Head, Department of Organic Chemistry and ex-Director, Indian Institute of Science, Bangalore for his outstanding contributions in the field of Organic Chemistry. Professor Banerjee delivered the Medal lecture on **'Development of convergent total synthesis of equilenane and estrane molecules'** at INSA, New Delhi, on 2nd january 1986. He received the award from Professor C N R Rao, President of the Academy, at the Anniversary General Meeting of the Academy on 2nd January 1986.

The earlier recipients of the award are:

Professor K Venkataraman, FNA (1973)
Professor R C mehrotra, FNA (1976)
Professor S C Bhattacharyya, FNA (1979)
Dr Sukh Dev, FNA (1982)

Chandrasekhara Venkata Raman Medal 1985

The Chandrasekhara Venkata Raman Medal was established by the Academy in 1979 to perpetuate the memory of the distinguished scientist Sir Chandrasekhara Venkata Raman. The Medal is awarded once every three years to a scientist for outstanding contributions in any branch of science coming within the purview of the Academy. The award carries a Copper Medal (Gold plated).

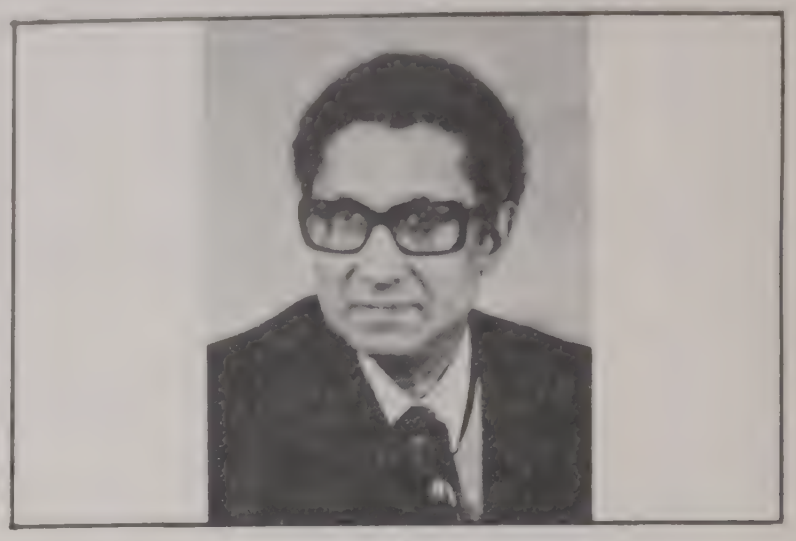
The Medal for the year 1985 has been awarded to Professor **Mambillikalathil Govind Kumar Menon**, FNA, FRS, Science Adviser to the Prime Minister and Member, Planning Commission for development of the nuclear emulsion technique. Professor Menon delivered the Medal Lecture on **'Proton decay'** at INSA, New Delhi on 2nd January 1986. He received the award from Professor C N R Rao, President of the Academy, at the Anniversary General Meeting of the Academy on 2nd January 1986.

The earlier recipients of the award are:

Dr Salim Ali, FNA (1979)
Dr G N Ramachandran, FNA (1982)

Dr **P M Bhargava**, FNA, Director, Centre for Cellular and Molecular Biology, Hyderabad has been awarded Padma Bhushan by the President of India.

Professor **C N R Rao**, FNA, FRS, President, Indian National Science Academy has been elected (a) Hon. Foreign Member, American Academy of Arts & Sciences. (b) Foreign Member, Serbian Academy of Sciences, Yugoslavia and (c) Vice-President, International Organization of Chemical Science for Development (IOCD).



Professor **S Chandrasekhar**, FNA, in the recipient of the (a) first Mahendralal Sircar Prize for Physics for 1984 awarded by Indian Association for the Cultivation of Science, Calcutta and (b) Jawaharlal Visiting Professorship in Physics in University of Combridge for 1986-87.

Dr **A P Mitra**, FNA, Director National Physical laboratory has taken over as Director-General, Council of Scientific and Industrial Research (CSIR) and Secretary, Department of Scientific and Industrial Research (DSIR).

Professor **M S Valiathan**, FNA, Director, Sri Chitra Tirunal Institute of Medical Sciences and Technology, Trivandrum has been award R D Birla Triennial International Award.

Professor **B L Deekshatulu**, FNA, Director, National Remote Sensing Organization, Hyderabad has been given NRDC award, 1986 for the development of 'Optical reflecting projector

Professor **R Cowsik**, FNA, has been awarded the Shanti Swarup Bhatnagar Prize for 1984 by the CSIR, New Delhi

Professor **A S Paintal**, FNA, FRS, Director Vallabbhai Patel Chest Institute, Delhi has been award Padma Vibhushan by the President of India.

Dr **M S Swaminathan**, FNA, FRS and Director-General, International Rice Research Institute, Manila has been awarded the University of Georgia Bicentennial Medallion in October 1985.

Dr **C V Sundaram**, FNA, Director, Reactor Research Centre, kalpakkam, Madras has been awarded Padma Bhushan by the President of India.

Dr **V S Arunachalam**, FNA, Scientific Adviser to the Raksha Mantri & Secretary, Department of Defence Research & Development has been awarded Padma Bhushan by the President of India.

Council Diary

Minutes of the 51st Anniversary General meeting of the Indian National Science Academy held at 6.00 p.m. on Thursday, the 2nd January 1986 at the Indian National Science Academy, New Delhi.

Members present

C N R Rao, President
P N Srivastava, Treasurer
T N Khoshoo, Foreign Secretary
S K Joshi Secretary
H Y Mohan Ram Secretary
A N Mitra, Editor of Publications
A K Sharma, Past-President
I P Abrol
Y P Abrol
U C Agarwala
J C Ahluwalia
R P Bambah
D K Banerjee
S Banerjee
A B Bhattacharyya
O P Bhutani
K S Bilgrami
S Chandrasekhar
S N Chatterjee
K L Chopra
V L Chopra
B Choudhury
P K Das
C M S Dass
J S Datta Munshi
Rajat De
D K Dutta Majumdar
S C Dutta Roy
N C Ganguli
S N Ghosh
K S Gill
P K Gupta
Akhtar Hussain
V G Jhingran
A C Jain
S K Jain
S K Joshi
R N Kapil
R S Kapil
S S Katiyar
S Kedharnath
M M T Khan
L S Kothari
Krishan Lal
C R Krishna Murti
R Krishnan
D N Kundu
K N Mehrotra
M G K Menon
R Misra
A P Mitra
S Mookerjee
K K Rohatagi Mukherjee
S K Mukherjee
Y S Murty
S M Naqvi
Prem Narain
H L Nigam
S C Pakrashi
B P Pal
R K Pal
Yash Pal
S P Pandya
D D Pant
R S Paroda
R C Paul
M K K Pillai
S S Prihar
V Puri
P S Ramakrishnan
V Ramalingaswami
A V Rama Rao
N S Randhawa
N K Ray
G M Reddy
R P Roy
S S Sandhu
Y S R K Sarma
S C Seal
S Sen
C S Seshadri
V C Shah
Archana Sharma
K N Sharma
M M Sharma
S K Sinha
N S Subba Rao
G Swarup
G P Talwar
H D Tandon
S Varadarajan
A R Verma
N H Wadia

Condolence on the passing away of Professor L S S Kumar and Shri S P Venkiteshwaran, distinguished Fellows of the Academy.

The deaths of Professor L S S Kumar and Shri S P Venkiteshwaran were condoled. All present stood in silence for one minute as a mark of respect to the deceased.

Confirmation of the minutes of the Annual General Meeting held on 1st October 1985.

The minutes of the Annual General Meeting held on 1st October 1985, read by Professor S K Joshi (Secretary) were confirmed.

To read the names of those whose nominations have been received for election to Fellowship since the last General Meeting.

The names of those whose nominations have been received for consideration for election to the Fellowship since the last Annual General meeting of the Academy, held on 1st October 1985, were read by Professor H Y Mohan Ram (Secretary)

Announcement of the award of the General Medal—Aryabhata Medal due for 1986.

The name of Dr S Ramaseshan, FNA for the General medal was announced.

Announcement of the award of INSA Chandrasekhara Venkata Raman Research Professorship 1986.

The name of Professor M G K Menon, FNA, FRS for the Professorship was announced.

Proposal for amendment of Rules 3(b) and 15 regarding election of Foreign Fellows.

The proposal for amendment of Rules 3(b) and 15 was approved.

Presentation of the Vishwakarma Medal 1985 and honorarium attached to the award to Professor M M Sharma, FNA.

The Vishwakarma Medal 1985 and the honorarium attached to the award were presented to Professor M M Sharma, FNA. The citation was read by Professor H Y Mohan Ram.

Professor Sharma delivered the lecture entiled 'Intensification of Heterogeneous reactions: Theory and practice' on 1st January 1986.

Presentation of the Srinivasa Ramanujan Medal 1985 to Professor C S Seshadri, FNA.

The Srinivasa Ramanujan Medal 1985 was presented to Professor C S Seshadri, FNA. The citation for the award, was read by Prof S K Joshi.

Professor Seshadri delivered a lecture on 'Standard Monomial theory and Geometry of Schubert varieties' on 1st January 1986.

Presentation of the Professor T R Seshadri Seventieth Birthday Commemoration Medal 1985 and honorarium attached to the award to Professor D K Banerjee, FNA.

The Professor T R Seshadri Seventieth Birthday Commemoration Medal 1985 and the honorarium attached to the award were presented to Professor D K Banerjee, FNA. The citation for the award was read by Professor H Y Mohan Ram.

Professor Banerjee delivered a lecture on 'Development of convergent total synthesis of equilenane and estrane molecules' on 2nd January 1986.

Presentation of the C V Raman Medal 1985 to Professor M G K Menon, FNA.

The C V Raman Medal 1985 was presented to Professor M G K Menon, FNA. The citation for the award was read by Professor S K Joshi.

Professor Menon delivered a lecture on 'Proton decay' on 2nd January 1986.

Admission of Fellows under Rule 13

The Fellows listed below, were admitted to the Fellowship of the Academy:

Name of the Fellow	*Introduced by*
Professor P K Gupta	Professor H Y Mohan Ram
Professor Y P Abrol	Professor H Y Mohan Ram
Professor R S Paroda	Professor H Y Mohan Ram
Professor S N Chatterjee	Professor H Y Mohan Ram
Professor N K Ray	Professor U C Agarwala
Dr I P Abrol	Professor K S Gill
Dr N H Wadia	Professor P N Tandon
Professor H D Tandon	Professor P N Tandon
Professor M K K Pillai	Professor C M S Dass
Professor V C Shah	Professor C M S Dass
Professor G M Reddy	Dr G S Venkataraman
Dr R Krishnan	Professor P Rama Rao
Professor A B Bhattacharyya	Professor A N Mitra

Dr S Sen	Professor P Rama Rao
Dr S M Naqvi	Professor P Rama Rao
Dr D K Dutta Majumdar	Professor P Rama Rao
Professor C S Seshadri	Professor A N Mitra
Dr S P Pandya	Professor A N Mitra
Dr Akhtar Hussain	Professor H Y Mohan Ram
Professor D D Pant	Professor P N Srivastava
Dr V G Jhingran	Professor J S Datta Munshi
Professor Y S Murty	Professor V Puri
Dr V Ramalingaswami	Professor P N Tandon

Anniversary Address by President, INSA

Professor C N R Rao, President, INSA delivered the Anniversary Address on 'Computer Simulation of Solid State Transformations and Molecular Trans formations on Solid Surfaces' (*see* Proc Indian natn. Sci. Acad., **52** A, No. 1, 1986).

Extract from the minutes of the meeting of the Council of INSA held on Thursday, the 2nd January, 1986.

Consideration of a proposal regarding institution of Dr Nitya Anand Endowment Lecture.

The Council approved the proposal regarding institution of Dr Nitya Anand Endowment Lecture out of an endowment of Rs 1,30,000 offered by the Organising Committee of 60th Birthday Celebrations of Dr Nitya Anand. The first award will be made in 1987.

Regulations approved are given in the **Annexure I.**

Consideration of the proposal regarding institutions of INSA Prize for Material Science.

The regulations regarding the INSA Prize for Material Science out of an endowment of Rs 50,000 from the Organizing Committee of the International Conference on the 'Application of Mossbauer Effect' as given in the **Annexure II** were approved.

Appointment of Advisory Boards for the Awards due for 1986 and consideration of guidelines for the awards.

The Council authorised the President to constitute the Advisory Boards for the awards due for the Year 1986.

The Advisory Boards constituted by the President are given in **Annexure III.**

The guidelines for the awards as given in the **Annexure IV** were approved.

INSA Nominees for CSIR Journals for the Editorial Boards (1985-87)

A total number of sixteen Fellows have been nominated by the Academy for the Editorial board of CSIR journals (*see* **Annexure V**).

The following items were reported to the Council

i) Nomination of Professor P N Tandon as INSA representative to attend the 55 Annual Session of National Academy of Sciences, India held on 3-5 November, 1985 at Jiwaji University, Gwalior.

ii) The nomination of Professor O Siddiqi as INSA representative to attend the 41st Annual Session of Sri Lanka Association for the Advancement of Science held in Colombo from 9-13 December, 1985.

iii) Agreement for sole distribution of INSA periobicals abroad by M/s J C Baltzer, A G Scientific Publishing Company, Switzerland after clarifications from the Department of Science and Technology.

iv) Designation of Professor P N Srivastava, Treasurer, INSA to look after the function of Secretaries INSA during their absence from the Headquarters from 21.11.1985 to 28.11.1985.

v) Nomination of Prof J C Ahluwalia, Prof R A Mashelkar and Professor D V S Jain as INSA representatives on the Selection Committee for the second biennial Professor Shanti Ranjan Palit Award—1987.

vi) Passing away of Dr B G Verma a nominee for consideration for election to Fellowship under Sectional Committee-I and of Prof L P Vidyarthi a nominee under Sectional Committee—VIII.

vii) INSA Research Professorship for 1987 to be named as INSA Srinivasa Ramanujan Research Professorship.

The above reports were noted and approved.

Science and Technology Communication and Popularisation Programme

A National Council for Science and Technology Communication (NCSTC) was set up during the Sixth Plan period, with a skeleton Secretariat in the Department of Science and Technology (DST); programmes and activities were formulated and some of them were initiated during 1984-85; major activities, however, were to begin with the Seventh Plan itself.

Important activities under the NCSTC programme are briefly described below:

(i) **Data Bases**

Generation and maintenance of uptodate computerised data bases on: (a) Agencies working in areas of interest to NCSTC: (b) S&T communicators in all Indian languages with their special areas of knowledge and communication skills; (c) Popular S&T magazines, journals, newspapers, S&T exhibitions, S&T films and other audio-visual materials available in the country, and (d) An uptodate status reports on areas of interest to NCSTC.

(This activity has already been initiated; a study has been sponsored to generate a data base on voluntary agencies engaged in S&T communication.)

(ii) **Training for S&T Communication**

Development and institution of effective mechanisms aimed at increasing the number of good and effective S&T communicators in the country, through training, orientation and awareness programmes.

Starting with pilot courses, training courses for communicators (in Hindi, English and other Indian languages), workshops for trainees and resource persons, awareness programmes for administrators and policy makers, development of training materials, development and formulation of regular courses, and courses in existing journalism schools are some of the other elements being planned under this head.

A scheme for award of a certain number of visiting fellowships for short durations to enable scientists/technologists to spend time in communication organizations and communicators to spend time in S&T organizations, is also being worked out.

(This activity has been initiated. One pilot course has been conducted at the Indian Institute of Mass Communication (New Delhi) and a second one is underway at the Space Applications Centre (Ahmedabad) at the time of writing).

(iii) **Research in S&T Communication**

Development of field-level projects in S&T communication with a view to researching, devising and developing far more effective communication methods, means, tools, techniques and technologies than those presently in use (for popularisation of science and technology and inculcation of S&T temper among people), the emphasis being on the 'software' rather than on hardware.

(Seed money has been given for a literature

based study in S&T communication for development of a field based project.)

(iv) **Science & Technology Information Network (Bureau)**

Building up of a National Science and Technology Information Network (NST IN), with appropriate linguistic extensions, to cater to the needs of S&T communicators in terms of authentic information and materials, in appropriate forms, languages, styles and at the required levels—and also to disseminate information about science and technology developments in India to the rest of the world.

A detailed proposal is under formulation for actualisation of a "Newsletter" which will cater to some of the essential needs of S&T communicators-as a first essential step towards building a National S&T Information Network. This "Newsletter" will be an English monthly, to be followed somewhat later by a Hindi Newsletter and subsequently, by similar efforts in different regional languages. With each one of these "Newsletters" will be attempted a computerised system of collecting, collating, storing, retrieving and delivering S&T information, visual and other materials etc. to communicators. These different "Newsletters" along with their concomitant information collection and delivery systems will, then, eventually become the interlinked elements of the National S&T Information Network.

(v) **S&T Communication Software**

Development and production of science and technology communication software for various media (including originals in different Indian languages) and its delivery through appropriate means and modes to various groups of our population; development of a network of small, local, region-specific S&T communication software production centres around the country; and production of software about S&T developments in India for dissemination abroad. The mechanism of inviting proposals for development and production of software will be used extensively.

Development of a countrywide (S&T communication) software dissemination network (non-broadcast mode) with the involvement of existing agencies including voluntary groups active in this field, with a view to ensuring quick and proper dissemination of existing software as well as of software that would be produced under this programme, among appropriate audiences comprised of different sections of entire population.

(This activity has been initiated and the first phase of a project to produce a science serial of 13 parts has been completed; the second phase i.e.; of production, is just about ready to commence.)

(vi) **Field-based Projects**

Support for and/or sponsorship of field-based projects directed towards achievement of any one or more of the objectives of the NCSTC's programme; workshops, seminars, symposia, rural exhibitions, jathas/yatras, science and technology melas/fairs, etc. will all be included. Under this head, there would be two broad categories of projects: (a) nationally relevant projects to be selected purely on the basis of merit and their relevance to the national context; and (b) a certain number of projects to be supported in each state/union territory on the basis of merit as well as on the basis of the level of their relevance to the state/region of their origin, preferably in association/partnership with the respective State Council of Science and Technology.

(vii) **Incentive Schemes**

(a) Awards, prizes, including fellowships and scholarships to be instituted at the state and national levels to promote, encourage and recognise outstanding work/effort in areas of interest to NCSTC, under various categories: best S&T coverage in newspapers, best S&T film, best S&T video programme, best S&T educational/do-it-yourself kit, best S&T toy, and several others.

(b) Contests, competitions to be instituted at the State and National levels to provide incentives for better and more vigorous efforts in areas of S&T communication.

(viii) **Others**

(a) Publications for S&T communication, originally written in Hindi and other Indian languages would be encouraged, promoted, and sponsored, for catering to different types of audiences—children and women audiences would be given a higher priority.

(b) Exhibitions and Fairs on relevant S&T subjects would be organised; supported or sponsored.

(c) Wider dissemination of existing S&T software in the form of films, video program-

mes, tape-slide shows, slides, audio-recordings etc.

(d) Science clubs would be encouraged and activated to make more vigorous efforts and assist the Council in one or more of its activities programmes.

(e) Popular lectures, seminars, symposia, including awareness and orientation programmes for policy-makers and administrators.

(f) Seed-money for project formulation in specified areas.

(g) Coordination and orchestration of S&T communication activities of the official agencies.

(h) And any other activities aimed at achieving one or more of the NCSTC's objectives.

(ix) **Monitoring and Evaluation**

Development of a computerised monitoring system to keep an eye on all different activities, projects/programmes of the Council. Development of evaluation methods and mechanisms.

□ □ □

RECENT INSA PUBLICATIONS

1. *Thrust Area in Astronomy and Astrophysics*—
J C Bhattacharyya and V R Venugopal, Rs. 8.00 US $ 3.00.

2. *Biological Monitoring of the State of the Environment*
(Proceedings of the Seminar), Rs. 100.00, US $ 35.00.

3. *Physics and Chemistry of Surfaces*
(Proceedings of the Seminar, New Delhi, 28-30 Sept. 1984),
Rs. 200.00, US $ 67.00.

4. *Science in India : 50 Years of the Academy*—
Editors : C N R Rao and H Y Mohan Ram, Rs. 125.00, US $ 42.00.

5. *Review of Floods in India during the past 75 years*
C Ramaswamy, Rs. 65.00, US $ 23.00.

6. *Plant Protection in the year 2000 AD*
(Proceedings of the Seminar held at New Delhi, Dec. 20-22, 1984),
Rs. 80.00, US $ 27.00.

7. *The Indian Lithosphere*—Rs. 40.00, US $ 14.00.

8. *Chromosome Structure*—A K Sharma
(Perspective Report Series No. 14)

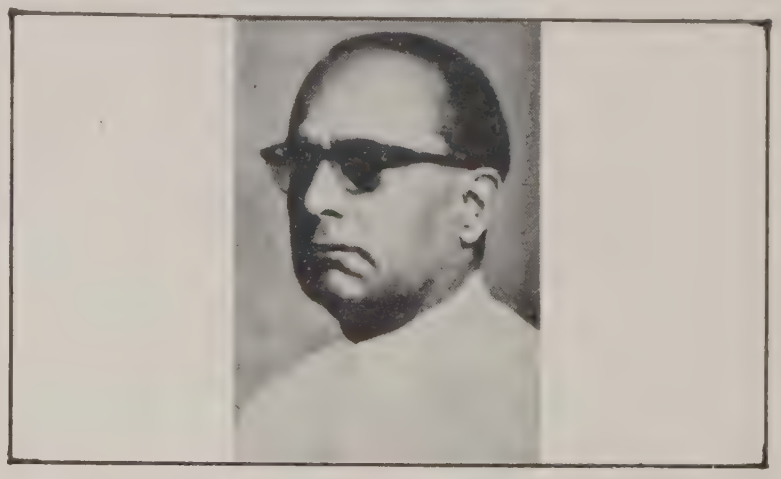
Obituary

Dr **Satya Prasad Raychaudhuri**, a Fellow of the Academy was born on 23rd April, 1904 and died on 3rd January, 1986. He received his B Sc Degree from University of Calcutta in 1932 and from University of London in 1945. He was the Head, Division of Soil Science and Agricultural Chemistry, IARI, New Delhi (1949-58); Chief Soil Survey Officer, IARI, New Delhi (1958 61); Senior Specialist (Land Resources), Planning Commission (1961-69); Chief Agronomist, Shriram Khad Programme, New Delhi.

Dr Raychaudhuri was the Fellow, National Academy of Sciences (India), Member, Indian Chemical Society, Indian Society of Soil Science (President, 1960-61), Indian Chemical Society, Indian Society of Soil Science, Indian Society of Agronomy, royal Institute of Chemistry (England), World Academy of Arts and Science, International Society of Soil Science; Honorary Member, USSR Society of Soil Scientists and President, Agricultural Sciences Section, Indian Science Congress Association (1955-56).

Dr Raychaudhuri initiated research work on red and lateritic soils in India. He prepared the soil map of India and initiated soil and land use survey. His work on soil testing and the use of balanced fertilizers led to the development of work in these fields. His study on agriculture in ancient India has led to the publication of several books and bulletins on the subject.

S P Raychaudhuri was elected to the Fellowship of Academy in 1952.



Shri **Ladapuram Srinivasa Sampath Kumar** was a Fellow of the Academy, born on 4th June, 1903 and died on 20th November, 1985. He received his M Sc Degree from University of London in 1927. He was an Economic Botanist to Government of Bombay and Principal, College of Agriculture, Poona; Chief of Agricultural Education, ICAR; Dean, Post-Graduate Research Institute, Principal Agricultural College and Additional Director of Agricultural Research, Kerala. He was a Fellow, Indian Academy of Science and Indian Society of Genetics and Plant Breeding.

Shri Kumar's significant research achievements included breeding of forage grasses and improved strains of grasses, legumes, oil seeds and pulses, cytological investigations, and induction of polyploidy in grain crops, vegetables, fruits and flowering plants.

L S S Kumar was elected to the Fellowship of Academy in 1954.

Mohinder Singh Randhawa, a Fellow of the Academy, was born on 2nd February, 1909 and expired on 3rd March, 1986. He did his postgraduation from Government College, Lahore (Panjab University) in 1930 and received his DSc degree in 1955 from Panjab University, Chandigarh. He joined Indian Civil Sarvice on the 23rd September, 1934 and held many important positions since then, such as Secretary, Imperial Council of Agricultural Research, New Delhi (1945-46), Deputy Commissioner, Delhi (1946-1948); Additional Director-General, Rehabilitation, Punjab (1949-51); Commissioner, Ambala Division (1951-53); Development Commissioner and Commissioner, Rehabilitation and Custodian, Evacuee Property (1953-55), Punjab; Vice-President, Indian Council of Agricultural Research and Additional Secretary, Government of India, Ministry of Food and Agriculture (1955-60); Adviser, Natural Resources, Planning Commission (1961-64); Special Secretary, Ministry of Food and Agriculture (1964-66); Chief Commissioner, Union Territory, Chandigarh (1966-68); Vice-Chancellor, Punjab Agricultural University, Ludhiana (1968-76).

Dr Randhawa was the recipient of Robe of Honour, Punjab Government for services to Punjabi Literature (1968); Fellowship of Indian Standards Institute (1968); Grant Gold Medal (1971), Royal Agro-Horticultural Society of India, Calcutta (1971); Padma Bhushan (1972); DSc (h.c. 1974), University of Udaipur; Honoured by the President of India for being an Innovator in Agriculture (1976).

Dr Randhawa was a man of many virtues. He was widely recognised as an upright administrator, an able scientist, a great exponent of Punjabi Literature, and had a deep understanding of art specially evident from his study on Kangra valley Paintings. As Deputy-Commissioner of Delhi (1946-48) and later Additional Director-General (Rehabilitation), Punjab (1949-51) people still remember the role he has played in stabilising the refugee population who migrated from different areas of pre-partition Punjab. A specalist in phycology, floriculture and agriculture, Dr Randhawa is credited with numerouspublications including many books. Some of the important books written by him are: *Beautifying India, Flowering Trees in India, Beautiful Trees & Gardens, Flowering Trees, Evolution of Life, Zygnemaceae* (a monograph), *Farmers of India* (Volume I to IV), *Kumaon Himalayas, Kangra Valley Paintings* (Six books allied topics), *Chamba Paintings, Indian Paintings, Art of E H Brewster and A Brewster, Art of Sushil Sarkar, Art of Damayanti Chawla, Art of Jyotish Bhattacharya, Art of R Sarangan*, etc. Dr Randhawa has contributed a series of books on *Natural Resources of India.*

Dr Randhawa was elected to the Fellowship of the Academy in 1943.

Annexures

Annexure I

REGULATIONS REGARDING DR NITYA ANAND ENDOWMENT LECTURE

The lecture has been established in 1986 out of an endowment of Rs 1,30,000 by the Organising Committee to celebrate the 60th Birthday of Dr Nitya Anand, an eminent chemist and a Fellow of the Academy. The funds came from Dr Nitya Anand's friends, students and admirers in academic institution and the pharmaceutical industry.

The lecture shall be delivered every alternate year by a scientist below 50 years of age who has done outstanding work in any area of biomedical research including new drug development. The award shall be based on work done in India during the previous 10 years. The first award will be made in 1987. The lecture shall be delivered in any institution involved in work in this area but not in the award winner's own institution. The lecturer will be paid Rs 25,000 including TA/DA for journeys performed to deliver the lecture.

Procedure for selection and other conditions (same as per lectures established from endowments and to be delivered under the auspices of the Local Chapters as indicated below).

Nominations — Nominations for consideration for the award shall be invited from the Fellowship. In addition, nominations may be called for from such institutions as may be approved by the Academy from time to time. The nomination paper shall specify (a) Full name, age and address of the nominee; (b) Academic and professional qualifications and positions held; (c) A brief statement (of about 300-350 words) of the outstanding contributions of the nominee in the discipline concerned, highlighting the impact of the work; and (d) A list of titles of the most significant published works.

Selection — The Council at the meeting to be held in May shall select a suitable candidate out of this list. The candidates proposed for the lecture should play no role in selection of the award.

Announcement — The name of the person selected by the Council for delivering this lecture shall be announced at the Annual General Meeting of the Academy in October.

Lecture subject and venue — The lecturer shall deliver a lecture on a subject of his choice at a venue selected by the Academy. The lecturer shall submit, in advance, three copies of the lecture which shall be published by the Academy and over which the Academy shall have the copyright.

Annexure II

REGULATIONS REGARDING INSA PRIZE FOR MATERIAL SCIENCES

(Established in 1986 out of an endowment of Rs 50,000/- by the Organising Committee of the International Conference on the Application of Mossbauer Effect, held in 1981.)

Name of the Prize : The Prize shall be called 'INSA Prize for Material Science'.

Eligibility and value : The prize shall be awarded every alternate year for outstanding contributions in Materials Science. *The first award shall be made in 1987.* Any citizen of India shall be eligible for consideration for the prize for outstanding work done in India. The prize money will consist of Rs 10,000/-

Nominations and last date : Nominations for consideration for the Prize shall be invited from the Fellowship in the first week of October preceding the year of the award. The nomination paper shall specify (a) Full name, age and address of the nominee; (b) Academic and professional qualifications and positions held; (c) A brief statement (for about 300-350 words) of the outstanding contributions of the nominee in the discipline concerned, highlighting the impact of the work; and (d) a list of titles of the most significant published works. the last date for receipt of nominations shall be 15th November.

Selection : The President shall appoint a Committee to consider the nominations and make recommendations to the Council. The recommendations of the Committee shall be considered by the Council in January and final selection made.

Announcement : The name of the scientist selected by the Council for the Prize shall be announced at the Anniversary General Meeting of the Academy.

Lecture and venue : The recipient of the Prize shall deliver a lecture on a subject of his choice at a venue selected by the Academy. The lecturer shall submit, three copies of the lecture which shall be published by the Academy and over which the Academy shall have a copyright.

Annexure III

ADVISORY BOARDS FOR THE AWARDS DUE FOR 1986

S N Bose Medal

—Theoretical Physics

1. INSA President
2. S K Joshi
3. C K Majumdar
4. M G K Menon
5. P M Mathews
6. R R Daniel
7. S Chandrasekhar

D N Wadia Medal

—Earth Sciences, Geology, Geophysics and Geochemistry.

1. INSA President
2. Anna Mani
3. Supriya Roy
4. A K Saha
5. B P Radhakrishna
6. S S Merh

J C Bose Medal

—Biochemistry, Biophysics, Molecular Biology and related areas.

1. INSA President
2. O Siddiqi
3. H Y Mohan Ram
4. B K Bachhawat
5. L K Ramachandran
6. C R krishna Murti
7. N K Notani

Golden Jubilee Commemoration Medal

—Chemical Sciences

1. INSA President
2. A Chakravorty
3. T R Kasturi
4. Sukh Dev
5. M M Taqui Khan
6. R P Rastogi

INSA-Vainu Bappu Medal

—Astronomy/Astrophysics

1. INSA President
2. R R Daniel
3. S K Joshi
4. J C Bhattacharyya
5. H Y Mohan Ram

S H Zaheer Medal

—Engineering and Technology

1. INSA President
2. P Rama Rao
3. M M Sharma
4. E C Subba Rao
5. R Narasimha
6. T R Anantharaman

Dhanwantari Prize

—Any branch of Medical Sciences.

1. INSA President
2. S Sriramachari
3. D K Dastur
4. B Ramamurthi
5. H D Tandon
6. N Gopinath
7. V Ramalingaswami

Golden Jubilee Commemoration Medal

-Biological Sciences

1. INSA President
2. R P Roy
3. S Sriramachari
4. T N Khoshoo
5. J Bamabas
6. H Y Mohan Ram

7. T N Ananthakrishnan
8. G Padmanaban

B N Chopra Lecture

—Biological Sciences

1. INSA President
2. R P Roy
3. N B K Nair
4. S Sriramachari
5. O Siddiqi
6. T N Khoshoo
7. H Y Mohan Ram
8. P N Tandon

Annexure IV

GUIDELINES FOR THE AWARD OF ACADEMY MEDALS/LECTURES

I. *GENERAL MEDALS/LECTURES*

At present the General Medals/Lectures are awarded for outstanding contributions in any branch of science coming within the purview of the Academy.

The General Medals/Lectures may also be awarded in recognition of service to the Academy or to Science.

II. *SUBJECTWISE MEDALS/LECTURES*

(Instituted by the Academy or from endowment)

i) The Subjectwise Medals/Lectures should be strictly awarded in the areas for which they are allocated as per recent decisions of the Council.

ii) Not more than one Subjectwise Medal/Lecture be awarded to a scientist. A Fellow of the Academy may be awarded a General Medal in addition to one Subjectwise Medal or lectureship.

iii) The award of Academy Medals/Lectures be normally awarded to Fellows. In exceptional circumstances and also in certain areas where nominees are likely to be from a broaden base of the scientific community, these may be awarded to non-Fellows.

Annexure V

List of INSA Nominees for the Editorial Board CSIR Journals (1985-87)

Indian Journal of Chemistry Part-A (Physical, Inorganic & Analytical Chemistry)

Professor P T Manoharan,
Professor of Chemistry & Head, Regional Sophisticated Instrumentation Centre, Department of Chemistry Indian Institute of Technology, Madras-600036.

Professor D V S Jain,
Professor of Physical Chemistry, Punjab University, Chandigarh-160014.

Indian Journal of Chemistry Part-B (Organic)

Professor S Ranganathan,
Department of Chemistry, Indian Indian institute of Technology, Kanpur-208016

Professor S V Kessar,
Professor in Organic Chemistry, Department of Chemistry, Punjab University, Chandigarh-160014.

Indian Journal of Physics

Professor P Krishna,
Professor of Physics, Banaras Hindu University, Varanasi-221005.

Professor S K Joshi,
Department of Physics, University of Roorkee, Roorkee-247672.

Indian Journal of Experimental Biology

Professor V S Ramadas,
Professor & Head, Department of Botany and Dean School of Biological and Earth Sciences, Sri Venkateswara University, Tirupati-517502.

Professor A S Mukherjee,
Professor of Zoology, Calcutta University, 35 Ballugunge Circular Road, Calcutta-700019

Indian Journal of Biochemistry

Professor A N Radhakrishnan,
School of Life Sciences, University of Hyderabad, Hyderabad-500001.

Professor B B Biswas,
Director, Bose institute, 93/1, Acharya Prafulla Chandra Road, Calcutta-700009.

Indian Journal of Radio and Space Physics

Professor G Swarup,
Radio Astronomy Centre, Tata Institute of Fundamental Research, Ootacamund 643001.

Professor M K Dasgupta,
P 282, kankurgachi Second Lane, Calcutta-700019

Indian Journal of Technology

Dr I K Doraiswamy,
Director, National Chemical Laboratory,
Pune-411008.

Professor S Ranganathan,
Department of Metallurgy, Indian Institute of Science, Bangalore.

Indian Journal of Marine Sciences

Dr V G Jhingran,
132, Indira Nagar Colony, Dehra Dun-248011 (U P)

Shri H N Siddiquie,
Deputy Director, National Institute of Oceanography, Dona Paula, Panaji, Goa-403004.

AN INVITATION TO THE NOMINATION FOR THE KING FAISAL INTERNATIONAL PRIZE IN SCIENCE

The General Secretariat of the King Faisal International Prize, in Riyadh, Kingdom of Saudi Arabia, has the honour to invite the Universities, Academies, Educational Institutions and Research Centers all over the world to nominate qualified candidates for the King Faisal International prize in science which will be awarded in 1407 AH i.e. 1987 AD.

(a) The topic of the prize will be "**MATHEMATICS**".

(b) Selection will be decided by a Committee consisting of national & international assessors selected by the board of King Faisal International Prize.

(c) More than one person may share the prize.

(d) The Winner's names will be announced in **December 1986**, and the prize will be awarded in an official ceremony to be held for that purpose in Riyadh, Kingdom of Saudi Arabia.

(e) The Prize consists of.

1. A certificate in the name of the winner containing an abstract of the work that qualified him/her for the prize.
2. A precious medal.
3. A sum of three hundred and fifty thousand Saudi Riyals (S.R. 350,000).

(f) The following conditions must be fulfilled:

1. A nominee must have accomplished outstanding academic work in the subject of the prize, leading to the benefit of mankind and enrichment of human thought.
2. The prize will be awarded for specific original research but the nominee's complete works will be taken into account.
3. The works submitted with the nominations must have been published.
4. The specific works submitted must not have been awarded a prize by any international educational institution, scientific organization, or foundation.
5. Nominations must be submitted by leading members of recognised educational institutions and of world-fame such as Universities, Academies & Research Centers. Nominations from other individuals and political parties will not be accepted.
6. Nominations must give full particulars of the nominee's academic background, experience and publications, as well as copies of his/her educational certificates, if available. Three 6 × 9cm photographs, full address and Telephone number of the nominee are also requested.
7. The nominations and selected publications (**ten copies**) are to be sent by registered air mail to the address stated in (10) below.
8. The latest date for receipt of the full nominations with copies of works is the **4th of Dhu Al-Hijjah 1406 AH. i.e. the 9th of August 1986 AD.** The nomination papers received after this date will not be considered unless the subject of the prize is postponed to the following year.
9. No nomination papers or works will be returned to the senders.
10. Enquiries should be made, and nominations should be sent, to the Secretary General of the King Faisal International Prize, P. O. Box 22476, Riyadh 11495, Kingdom of Saudi Arabia, Telex 204667 PRIZE SJ.

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